CLAIMS

What is claimed is:

1 1. A method for detecting characteristics of an object, the method comprising:

2 identifying a projection array used to project coded light onto a scene containing the

3 object, wherein the projection array comprises a plurality of projection elements;

4 obtaining an image of the scene with the coded light projected onto it;

5 identifying a plurality of image elements forming an image array from the image; and

6 for each image element, determining correspondence information that can be used to

7 determine which projection element in the plurality of projection elements corresponds to

8 that image element, wherein determining correspondence information for each element is

9 performed independently of knowing correspondence information for any other image

10 element.

1 2. The method of claim 1, further comprising:

2 determining position information for each identified image element based at least in

3 part on the correspondence information for that image element.

1 3. The method of claim 1, further comprising:

2 determining position information for each identified image element based at least in

3 part on the correspondence information for that image element and on a position of a

4 projector that supplies the projection array relative to a camera that obtains the image array.

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1 4. The method of claim 1, wherein determining correspondence information includes:

2 determining a row coordinate and a column coordinate in the image array for one or

3 more image elements based at least in part on a row coordinate and a column coordinate in

4 the projection array.

1 5. The method of claim 1, wherein determining correspondence information includes:

2 determining a row coordinate and a column coordinate in the image array for one or

3 more image elements; and

4 for each of the one or more image elements, determining a row coordinate and a

5 column coordinate for an element in the projection array that corresponds to that image

6 element.

1 6. The method of claim 1, wherein the step of determining correspondence information

2 is performed without having to first determine correspondence information for an element in

3 the plurality of image elements that is designated as calibrating the correspondence

4 information for all other image elements in the plurality of image elements.

1 7. The method of claim 1, wherein the step of determining correspondence information

2 is performed without having to first determine correspondence information for an element in

3 the plurality of image elements that is designated as being a first element in a sequence of

4 elements that correspond substantially to an entire row of elements in the projection array.

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1   8.   The method of claim 1, wherein the step of determining correspondence information

2   includes identifying missing image elements by identifying one or more projection elements

3   that have no corresponding image element in the image array.

1   9.   The method of claim 8, further comprising the step of compensating for the missing

2   image elements by using image elements that are congruent to the missing image elements.

1   10.   The method of claim 1, wherein identifying a projection array includes identifying

2   data representing a tangible medium used to pattern light emitted from a projector.

1   11.   The method of claim 1, wherein identifying a projection array includes identifying

2   data representing a diffraction pattern for structuring light emitted from a projector.

1   12.   The method of claim 1, further comprising the step of projecting coded light onto the

2   scene to create a pattern of elements having a detectable characteristic belonging to a set of

3   two or more characteristic, wherein the pattern of elements is created from the projection

4   array.

1   13.   The method of claim 12, wherein each of the characteristics in the set is a geometric

2   characteristic that is distinguishable from an other geometric characteristic in the set.

1   14.   The method of claim 12, wherein each of the characteristics in the set is a color that is

2   distinguishable from an other color in the set.

1   15.   The method of claim 12, wherein each of the characteristics in the set is a shape that

2   is distinguishable from an other shape in the set.

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1 16.   The method of claim 12, further comprising:

2 determining a sequence of values that can identify each of the projection elements in the

3   projection array;

4 assigning a value used in the sequence to each characteristic in the set of two or more

5   characteristics; and

6 wherein the step of projecting coded light includes projecting each projection element in the

7   projection array as one of the characteristics in the set of two or more characteristics

8   so that the sequence can be at least partially reflected in the pattern based on the value

9   assigned to each characteristic.

1 17.   The method of claim 16, wherein assigning a value used in the sequence includes

2 assigning a binary value.

1 18.   The method of claim 16, wherein determining a sequence of values includes

2 determining the sequence comprising non-repeating binary values.

1 19.   The method of claim 18, wherein determining the sequence includes using a non-N-

2 repeating bit assignment formula.

1 20.   The method of claim 18, wherein determining the sequence includes assigning a

2 subset of the sequence to individual column coordinates in order to correspond elements in

3 the projection array with elements in the image array.

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1   21.   The method of claim 12, wherein projecting coded light onto the scene to create a

2   pattern of elements includes creating the pattern so that the detectable characteristics identify

3   columns in the projection array and so that each row in the projection array has the same set

4   of columns.

1   22.   The method of claim 12, wherein projecting coded light onto the scene to create a

2   pattern of elements includes creating the pattern so that the detectable characteristics identify

3   columns in the projection array and so that the columns are repeated in a staggered

4   arrangement.

1   23.   The method of claim 22, further comprising determining which projection elements in

2   the projection array have no corresponding image element using the staggered arrangement.

1   24.   The method of claim 21, further comprising determining which projection elements in

2   the projection array have no corresponding image element by identifying which rows in the

3   image array do not have the same columns.

1   25.   The method of claim 1, wherein one or more steps of the method are performed by

2   one or more processors executing instructions stored on a computer-readable medium.

1   26.   A method for creating a light pattern on a scene, the method comprising:

2   creating a sequence of values comprising a plurality of subsequences, wherein each

3   subsequence identifies one or more elements of a projection array independent of any other

4   element in the projection array;

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5   assigning a value to a characteristic in a set of optically distinguishable

6   characteristics;

7   projecting light in a pattern in order to create at least a portion of the pattern on the

8   scene, wherein the sequence is encoded into the pattern based on the value assigned to each

9   characteristic in the set.

1   27.   The method of claim 26, wherein each of the characteristics in the set is a geometric

2   characteristic that is distinguishable from an other geometric characteristic in the set.

1   28.   The method of claim 26, wherein each of the characteristics in the set is a color that is

2   distinguishable from an other color in the set.

1   29.   The method of claim 26, wherein each of the characteristics in the set is a shape that

2   is distinguishable from an other shape in the set.

1   30.   The method of claim 26, wherein assigning a value used in the sequence includes

2   assigning a binary value.

1   31.   The method of claim 26, wherein creating a sequence of values includes determining

2   a sequence comprising non-repeating subsets of binary values.

1   32.   The method of claim 31, wherein determining the sequence includes using a non-N-

2   repeating bit assignment formula.

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1 33.   The method of claim 26, wherein creating a sequence of values includes assigning a

2 subset of the sequence to individual column coordinates in order to correspond elements in

3 the projection array with elements in the image array.

1 34.   The method of claim 26, wherein one or more steps of the method are performed by

2 one or more processors executing instructions stored on a computer-readable medium.

1 35.   A system for detecting characteristics of an object, the system comprising:

2   a projector configured to project coded light that is created from a projection array

3 onto a scene containing the object, wherein the projection array comprises a plurality of

4   projection elements;

5   a camera system to capture an image of the scene with the coded light; and

6   a processor coupled to the processor and configured to:

7   determine correspondence information that can be used to determine which projection

8 element in the plurality of projection elements corresponds to a particular image element.

1 36.   The system of claim 35, wherein the processor is configured to determine the

2 correspondence information independently of determining correspondence information for

3 other elements in the image array.

1 37.   The system of claim 35, wherein the processor is configured to determine the

2 correspondence information independently of determining correspondence information for all

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3   other elements in the image array except for a set of congruent image elements that include

4   the particular image element.